ENVIRONMENTAL • GEOTECHNICAL
BUILDING SCIENCES • MATERIALS TESTING

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March 9, 2020

Ms. Kenya M. Anderson, MSP
Highlands County Board of County Commissioners
Engineering Department
505 South Commerce Avenue
Sebring, Florida 33870

Subject: Geotechnical Investigation for Roadway Improvements
CR 623 (Kenilworth Boulevard)
Between Haywood Taylor Boulevard and Mini Ranch Road
Sebring, Florida

Dear Ms. Anderson:

The following information provides the results of our geotechnical investigation of the subject site.

1 General

ATC has performed a geotechnical investigation for roadway improvements of a section of CR 623 (Kenilworth Boulevard) as shown in Figure 1 of Appendix A. The scope of work consisted of drilling two Standard Penetration Test (SPT) borings to a depth of 20 feet below land surface (bls) and one SPT boring to a depth of 50 feet bls. The boring logs can be found in Appendix B and a soil profile can be found in Figure 2 of Appendix A.

This report provides the results of our investigation and provides recommendations for roadway improvements based on our field observations and analysis of the subsurface data. Specifically, the report contains a description of existing site conditions, a description and evaluation of the subsurface conditions, and foundation recommendations for stability of the roadway.

2. Existing Roadway Conditions

In general, the section of roadway studied was found to be in poor but serviceable condition. It is estimated that this portion of roadway is at least 20 years old and cores drilled in the roadway (see previous report by ATC dated July 15, 2019) show evidence of at least five asphalt overlays. A variety of problems were found in the roadway resulting from poor drainage and insufficient structural support of the roadway section.

For the most part, the studied section of roadway appears to have been developed by a combination of cut on the south side of the roadway and fill on the north side of the roadway. It is the north side of the roadway that has developed tension cracks that extend in an approximate north-south directions (see Figure 3 in Appendix 1). These cracks indicate that the roadway is moving downward as shown in the figure.

3. Field Testing

On February 19, 2020 ATC completed the three SPT borings in the roadway. The location of the borings is shown in Figure 1 of Appendix A. Table 1 provides a sediments found at each SPT boring location.

4. Subsurface Conditions

4.1 Borings

To aid in characterizing soil conditions, Table 1 was developed to provide the type of sediments found and the range in depth of the sediments that comprise the soil section effecting roadway performance. Note, the depth of the borings was extended or decreased so as to assure dense soil material was sampled in all borings. For example, borings B-2 and B-3 were extended from 20 feet to 25 feet to assure continuity of the soil conditions found at the bottom of the borings while B-1 was decreased from a depth of 50 feet to a depth of 35 feet since conformation of dense soil conditions was obtained at 35 feet.

Table 1, Summary of Soil Conditions Found in Borings

Soil No.	Description of Soil	Depth Range (feet)		
		B-1	B-2	B-3
1	Loose Sand	0 – 14	0 – 14	0 – 14
2	Medium Dense Sand	14 – 23	NF	14 – 19
3	Organic Sand	NF	14 - 19	NF
4	Dense Sand	23 – 35	19 – 25	19 – 25

NF – Not Found

4.2 Groundwater

Groundwater was found in all borings at a depth of approximately 8.0 feet bls. Groundwater was not found to intersect the downstream slope face in any areas visible from limited observation of the cleared slope face and from observations made at the toe of slope (see photos in Appendix B). Note, accurate groundwater measurements can only be accomplished by the use of observation wells or piezometers that are monitored for a minimum period of 48 hours. It is expected that groundwater movement will follow the embankment slope and intersect the ground surface at the stream found at the toe of slope.

5. Laboratory Testing

Samples of subgrade soils were visually classified in the laboratory by a senior geotechnical engineer in general accordance with ASTM D 2488. All subgrade soils consisted of fine sand with trace amounts of silt. In boring B-2 approximately 4-feet of loose black silty fine sand was found with an organic content of 29.5% and a percent passing the No 200 sieve of 24.2%. No appreciable amounts of clay were found in any of the samples.

6. Analysis of Roadway

6.1 Elements of Embankment Performance

For the purposes of this investigation, roadway condition is dependent on essentially five elements: 1) the integrity of the asphalt pavement, 2) the thickness and density of the base course, 3) the density (strength) of the subgrade, 4) drainage of the roadway and 5) the stability of the overall embankment. All of these elements affect the condition of the asphalt wearing surface. If one or more of these elements are compromised the asphalt wearing surface will show signs of distress.

The longitudinal cracking (tension cracks) in the roadway section being investigated is an example of the fifth element. That is, the roadway is being affected by the stability of the embankment. The following sections discuss embankment stability and remediation.

6.2 Stability

In our report dated July 15, 2019, we addressed many of the critical elements discussed in Section 6.1. It is understood, from the information developed in the earlier report that the pavement is in poor but serviceable condition and that any improvement to the roadway should consider renewal of the pavement and base. The following discussions will address the problems with the embankment supporting the roadway and how to remediate the embankment.

6.2.1 Existing Section

Figure 2 provides a typical section of what is occurring in the fill portion of the roadway in the area of the three borings drilled for this investigation. It is estimated that the embankment slope is about 1V:2H and the height of the embankment above the broad flat area to the north is about 15 feet.

6.2.2 Other Factors

1. <u>Debris</u>

Debris consisting of tires and wood materials was exposed in some areas of the slope (see site photos in Appendix 3). It is suspected that some of the debris consists of material thrown down the slope by passing traffic although there is some evidence that the material may have been in the original fill used to form the embankment. The presence of this material has a negative impact on slope stability since it may define a zone of weakness in the slope.

2. Fill

A further complication is the fill used for the roadway was likely not compacted when it was placed. This is seen in the loose sand (low N-values) found in the borings, illustrated in the Figure 2 profile and in Table 1.

3. Organic Material

A further negative feature found in the embankment is organic material occurring in boring B-2. In general, organic material is associated with low strength conditions; however, the position (depth) of the organic material is where one would expect a shear surface to occur. Depending on the distribution and thickness of the organic soil, it may have a controlling effect on the stability.

4. Existing Distress

The tension cracks shown in Figure 3 are indicative of slope movement as illustrated in the figure. The presence of these tension cracks suggests that there are existing failure surfaces in the slope that must be mitigated to prevent further cracking in new or renovated pavement. If this slope is not stabilized, cracking will continue in the new pavement.

7. Recommendations for Remediation

The most cost effective method of stabilizing the slope is to first remove the vegetation on the side slope in the areas where longitudinal cracking occurs. Following removal of the surface vegetation, the slope should be inspected for any zones of debris or zones of concentrated organic material. If present and of sufficient extent, these zones could serve as a plane for slippage. If such a condition exists, it may indicate fill was dumped on existing debris or organic material which could serve as a plane of weakness. Remediation of the presence of deposits of organic material and other conditions will depend on the type of material and its vertical and horizontal extent.

Following removal of the vegetation growing on the slope and inspection of the slope, the slope should be flattened to attain a slope as close to 1V:3H as possible. This should be accomplished by adding fill to the slope to extend the toe of the slope closer to the drainage ditch near the toe of slope. Prior to placing fill on the slope, the existing slope should be scarified and the new granular fill placed in a maximum loose lifts thickness of 18-inches. The new fill should be tracked-in by the use of a dozer or other tracked vehicle.

We appreciate the opportunity to provide our recommendation to the Highlands County Board of County Commissioners and welcome any questions you may have.

Please do not hesitate to call our office.

Sincerely,

Ed Zisman
Mar 9 2020 9:28 AM

E. D. Zisman, P.E., S.I., P.G.
Geotechnical Division Manager
Florida Registration No. P.E. 53451

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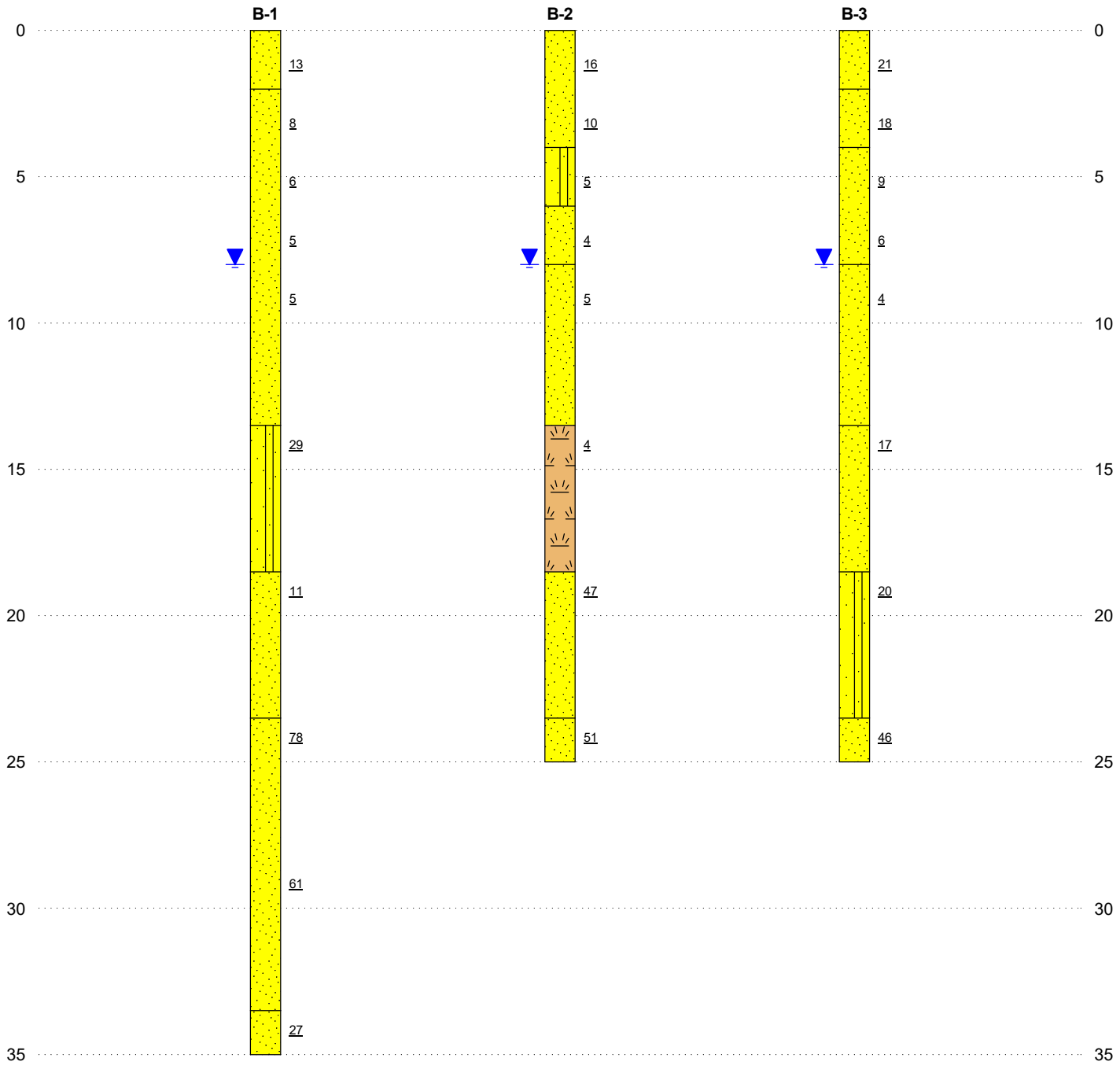
Appendix A
Figures

ATC	Geotechnical Investigation for Roadway Improvements			
	SR-623 (Kenilworth Boulevard) Sebring, Florida	ATC Project No. Z520840003	Figure 1 Boring Location Plan	Locations are approximate



LEGEND

- Loose to very dense, fine SAND (SP)
- Loose to medium dense, slightly Silty SAND (SP-SM)
- Loose, black, Silty SAND with Oraganics (SM)

(SP) Unified Soil Classification System

10 SPT N-value

5-5-5 Blow Counts (6 in. increments)

Loss of drilling fluid circulation

Observed groundwater

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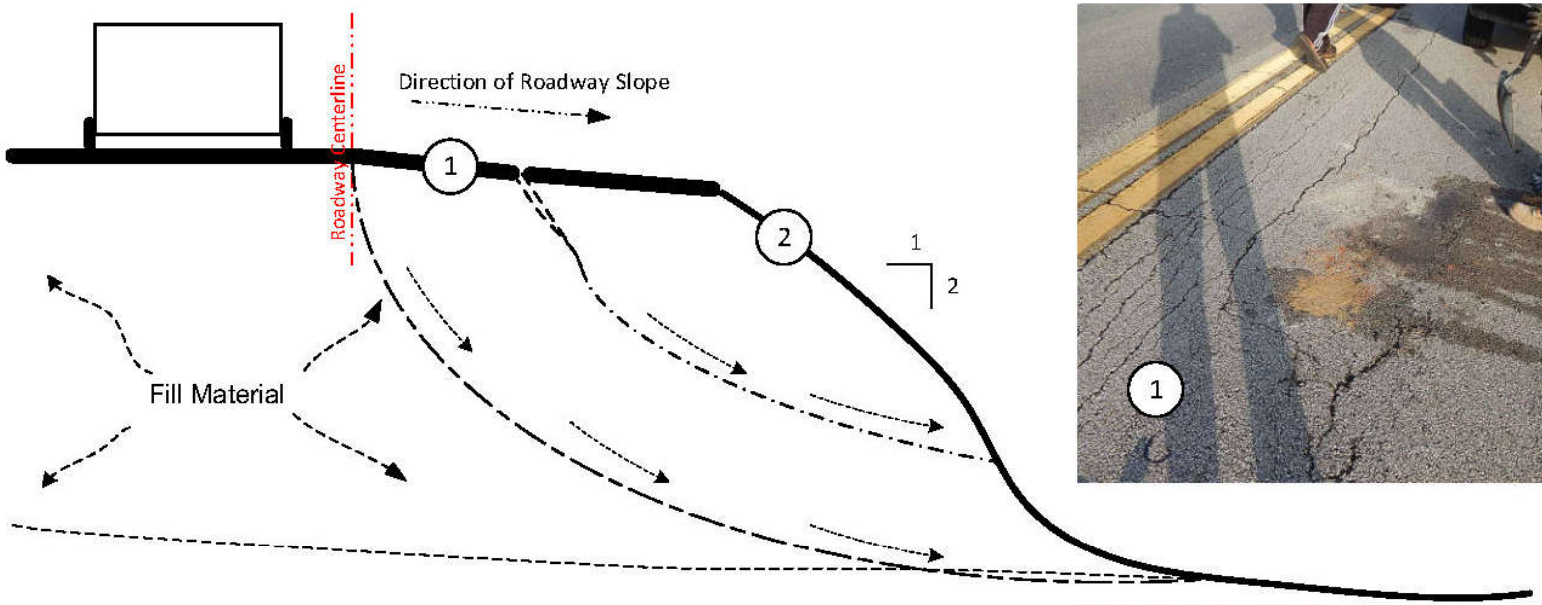
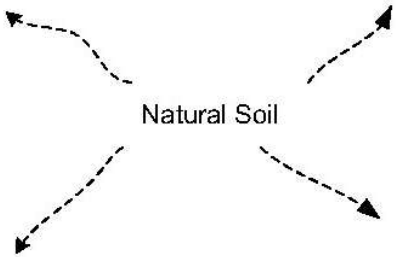
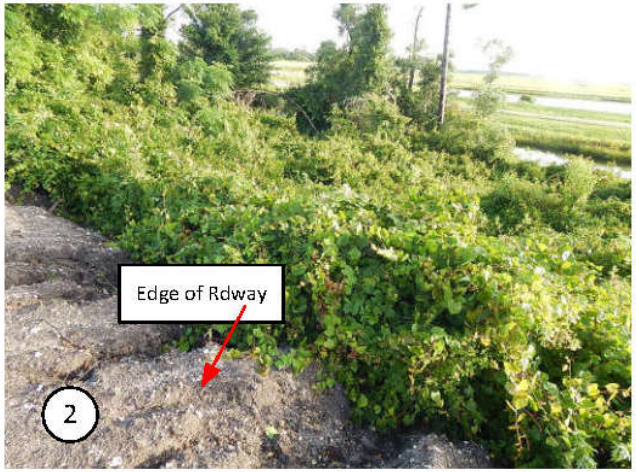
SR 623 (Kenilworth Blvd), Sebring, FL

Highlands County	SUBSURFACE PROFILE	Figure 2
	ATC Project No: Z520840003	Drill Date: 2/19/20







ATC	**Pavement Evaluation**		
	CR 623 from Haywood Taylor Blvd to Mini Ranch Rd Sebring, Florida	ATC Project No. Z520840003	Figure 3 Typical Stability Section

Appendix B
Boring Logs

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BOREHOLE LOG: B-1

Depth BGS (ft.)	Graphic Log	MATERIAL DESCRIPTION	BLOW COUNTS	N VALUE	N Values vs. Depth (0 10 20 30 40 50)	REMARKS
		Medium dense, light brown, fine SAND (SP)	10-7-6-6	13		
		Loose, dark gray, fine SAND (SP)	4-4-4-5	8		
5			4-3-3-3	6		
			2-2-3-2	5		Groundwater observed at approximately 8 feet bls
			1-2-3-2	5		
10						
		Medium dense, dark gray, slightly Silty, fine SAND (SP-SM)	4-12-17	29		
15						
		Medium dense, dark gray, fine SAND (SP)	6-4-7	11		
20						
		Very dense, dark brown, fine SAND (SP)	12-28-50	78	>>	
25						
			21-26-35	61	>>	
30						
		Medium dense, dark brown, fine SAND (SP)	16-15-12	27		*borehole terminated at 35 ft bls*

Client: Highlands County
Project: SR 623 (Kenilworth Blvd)
Location: Sebring, FL
ATC Project Number: Z520840003

Date Drilled/Backfilled: 2/19/2020
ATC Inspector: CK
Groundwater Observed (ft bls): 8

Hammer Weight: 140 lbs.
Hammer Drop: 30 in.
Drill Method: Mud Rotary

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BOREHOLE LOG: B-2

Depth BGS (ft.)	Graphic Log	MATERIAL DESCRIPTION	BLOW COUNTS	N VALUE	N Values vs. Depth (0 10 20 30 40 50)	REMARKS
		Medium dense, light brown, fine SAND (SP)	6-8-8-6	16		
			5-4-6-6	10		
5		Loose, brown, slighly Silty, fine SAND (SP-SM)	4-2-3-3	5		
		Loose, light brown, fine SAND (SP)	2-2-2-2	4		Groundwater observed at approximately 8 feet bls
		Loose, brown, fine SAND (SP)	2-2-3-4	5		
10						
		Loose, black, Silty fine SAND, with Organics (SM)	1-1-3	4		Organic Content = 29.5% % passing -200 = 24.2%
15						
		Dense, white, fine SAND (SP)	15-24-23	47		
20						
		Very dense, dark brown, fine SAND (SP)	15-24-27	51	>>	*borehole terminated at 25 ft bls*

Client: Highlands County
Project: SR 623 (Kenilworth Blvd)
Location: Sebring, FL
ATC Project Number: Z520840003

Date Drilled/Backfilled: 2/19/2020
ATC Inspector: CK
Groundwater Observed (ft bls): 8

Hammer Weight: 140 lbs.
Hammer Drop: 30 in.
Drill Method: Mud Rotary

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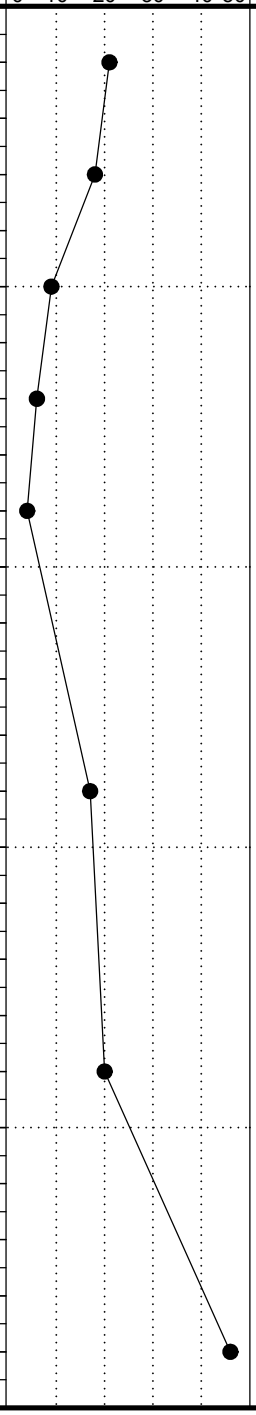
BOREHOLE LOG: B-3

Depth BGS (ft.)	Graphic Log	MATERIAL DESCRIPTION	BLOW COUNTS	N VALUE	REMARKS
		Medium dense, brown to white, fine SAND (SP)	9-10-11-13	21	
		Medium dense, gray, fine SAND (SP)	10-9-9-8	18	
5		Loose, dark gray, fine SAND (SP)	5-5-4-3	9	
			1-3-3-3	6	Groundwater observed at approximately 8 feet bls
		Loose, gray, fine SAND (SP	3-2-2-2	4	
10					
		Medium dense, dark gray, fine SAND (SP)	9-9-8	17	
15					
		Medium dense, brown, slightly Silty fine SAND with Roots (SP-SM)	7-10-10	20	
20					
		Medium dense, dark brown, fine SAND (SP)	16-21-25	46	*borehole terminated at 25 ft bls*



Client: Highlands County
Project: SR 623 (Kenilworth Blvd)
Location: Sebring, FL
ATC Project Number: Z520840003

Date Drilled/Backfilled: 2/19/2020
ATC Inspector: CK
Groundwater Observed (ft bls): 8

Hammer Weight: 140 lbs.
Hammer Drop: 30 in.
Drill Method: Mud Rotary

Appendix C
Site Photographs

Photo 1: Installation of boring

Photo 2: Installation of boring

Photo 3: Close-up of Photo 2

Photo 4: View of slope below roadway (in the area of B-1)

Photo 5: Additional view of slope

Photo 6: Additional view of slope

Photo 7:Pictures of slope

Photo 8: Roadway slope in the vicinity of B-2

Photo 9: Slope below roadway

Photo 10: Various debris was found in the slope (tires, timber etc)

Photo 11: Typical vegetation covering slope (5 foot rod on slope)

Photo 12: Stream flow at the base of the slope